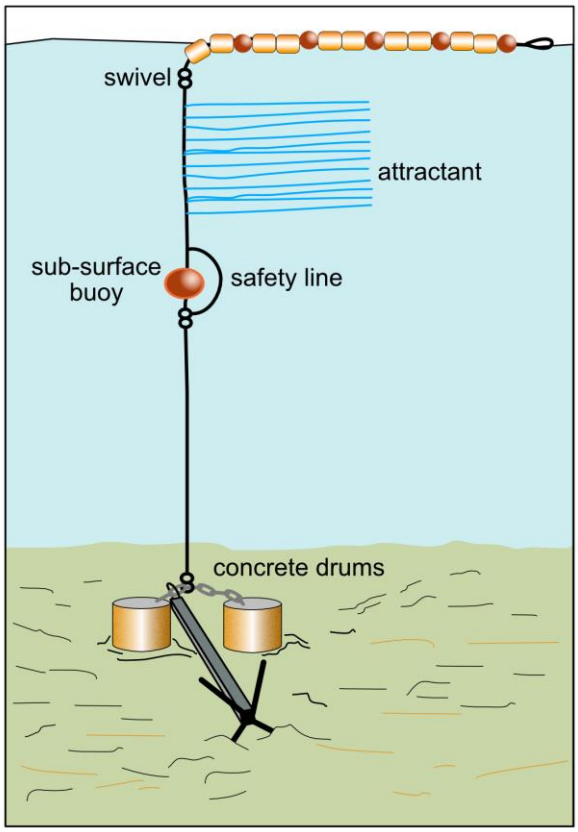
Compendium of Adapted technologies and practices for Agriculture and Fisheries in Timor-Leste

Nearshore Fish Aggregating Devices (FADs)

<table>
<tr><td>Climate Smart</td><td colspan="2">Fisheries and aquaculture</td></tr>
<tr><td>Overall approach/Local Context</td><td colspan="2">Fisheries in Timor-Leste are very small-scale. Fishing is undertaken on foot (gleaning), and in unpowered canoes and small motorboats, targeting reef and nearshore pelagic fish primarily with gill nets, hand lines, spear guns and long lines. Reef fisheries are nearshore and diverse, but limited in productivity and sustainability due to their restricted distribution and the broader climate impacts affecting corals worldwide such as warming and ocean acidification. Pelagic and semi-pelagic fish represent more abundant stocks of highly mobile, rapidly reproducing fish that are generally higher in natural oils than reef fish.
For a country focused on combating chronic malnutrition and micronutrient deficiency, fish provide a valuable potential source of bioavailable micronutrients and animal protein that is lacking in the diet of many Timorese. Since independence, there has been very little focus on fisheries and resource for development of the sector at limited.
Nearshore fish aggregating devices were proposed and tested as a way to enable fishers to access an abundant and sustainable source of nutritious fish using their existing boats and fishing methods.</td></tr>
<tr><td>Technology and Practice</td><td>1. Nearshore fish aggregating devices</td><td>• Improved access to more abundant nutritious fish
• Tested in Bobonaro, Baucau, Viqueque, Dili (Atauro) since 2016
• Improves fisher income and fish production</td></tr>
<tr><td>Description</td><td colspan="2"> 

What is a FAD? Fish aggregating devices (FADs) or rumpon, are anchored or drifting objects deployed in the ocean to attract fish. Pelagic fish gather around FADs (either for refuge, or to hunt smaller fish), which makes it easier to find and catch them. In artisanal fisheries, FADs are used to attract oceanic fish nearer to shore to be within reach of fishers in small motor boats or paddle canoes. This can have important benefits to sustainability, as it can relieve fishing pressure on less resilient reef and seagrass communities.
We tested the effects of FADs at increasing capture fish production, by deploying eight experimental FADs at four sites around the country (Vemasse, Baucau; Adarai, Viqueque; Beacou, Bobonaro; Adara, Atauro Island) and recording catch and effort data from FAD and non-FAD fishing trips. We assessed the effects of FADs on catch rates and catch assemblage and the rate of 100% return on investment. We estimated the upfront FAD cost to be USD 1250.
Results showed that <u>FADs lasted for ~11 months on average across all sites, but as long as 20+ months when well monitored and maintained. FADs increased fish catch and paid for themselves in ~5 months or less at three out of four sites</u> (Beacou showed no detectable difference in catch rate).
Across all sites and fishing types, 63 species were identified, but FAD catches significantly reduced overall assemblage diversity, with three species representing 96% of the catch (Sardinella spp. (Sardina), Decapterus macarellus (kombong), Rastrelliger brachysoma (bainar mutin). Despite the relatively short longevity of FADs deployed in Timor-Leste to date, the fast rate of return seen at most sites indicates that FADs are effective in providing livelihood benefits in certain locations. <u>Catch rates were highest where fishers were specialized, invested in FAD fishing, and formed catch sharing groups with access rights to specific FADs. National level investment into a FAD programme by the government could realistically increase overall fish production in the country, thereby improving availability of micronutrient rich fish to combat malnutrition.</u> A deployment program should be coupled with capacity building around group formation and defining access rights to ensure equitable community benefits.</td></tr>
<tr><td>Impacts/benefits</td><td colspan="2">Benefits of artisanal nearshore FADs in Timor-Leste
• Food & nutrition security: increased catch rate and improved access to healthy source of oceanic fish;
• Coastal resource management: transfer of fishing effort from the reef to the ocean;
• Climate change adaptation: Food security buffer to socio-economic and climate shocks and resilience of coral</td></tr>
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	reef ecosystems; • Improved fisher wellbeing: Safety at sea improvements through defined fishing zones around FADs, and improved income.
Barriers to adoption & solutions	**Governance and social conflict:** FADs can cause increased social tensions in communities if they are perceived as owned by individuals or groups that exclude other fishers. Clearly defined boundaries are important in managing common resources [1], and this private governance scenario is one that tends to bring better returns even if these are not necessarily legally recognized boundaries [2] (see [3] for more on governance challenges to FADs). **Sustainability**: Further to the above, privately owned and managed FADs are also likely to last far longer because they will be checked on regularly and maintained [4]. If no one owns it, everyone will fish on it but no one will maintain it. In the same way, FADs that are provided to 'the fishing community' by the government may have limited sustainability unless combined with a campaign and capacity building on fisheries association or group formation, and defining access rights to ensure equitable community benefits. **Costs of construction and deployment**: In experimental trials FAD construction materials were more expensive than would be used in a larger scale deployment program. Assuming equal efficacy at aggregating fish of low and high-cost FADs, this indicates RoI wouldbe achieved even faster by reducing the initial investment cost. However, quality should not be compromised because of cost because a well-made FAD that lasts much longer will support livelihoods over a longer period of time and also reduce marine debris [5]. However, if FADs are used by individual fishing groups in coastal communities (as opposed to a government program), they may lack the resources to purchase higher quality ropes and buoys. Furthermore, in Vemasse and Adarai, fishing on the FADs was only conducted seasonally when conditions were favorable, indicating a year-round FAD may be subject to wear and tear and be accumulating biofouling for a significant amount of time whileit is not being fished. In this instance, low-cost FADs would be more appropriate. **Safety at sea**: FADs enable access to fishing areas further from the coast than traditional fishing areas, safety at sea becomes an important risk factor for fishers as they face different environmental conditions. Fishers often do not have safety equipment on board, because it is expensive and considered unnecessary [6]. Given that there is currently no specific regulation on safety at sea for small-scale fishers in Timor-Leste, developing a legal framework alongside a FAD program will be important.
Environment/ agro-ecological zone	FADs can only be deployed in areas of sufficient depth and limited slope and current, so that the anchor can bind to the sea floor and currents do not wash the FAD into deep water or snap the mooring line. To adequately evaluate the location for deployment, a depth sounder is needed to survey the area before the FAD is built and deployed. Furthermore, the amount of fish that gather around the FAD will depend on the ecology of the area. This is something that must be local fisher ecological knowledge in the absence of formal fisheries surveying.
References	[1] Ostrom E. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press; 1990. [2] Govan H. Status and potential of locally-managed marine areas in the Pacific Island Region: meeting nature conservation and sustainable livelihood targets through wide-spread implementation of LMMAs. 2009; 95. [3] Pittman J. et al., Governing offshore fish aggregating devices in the Eastern Caribbean: Exploring trade-offs using a qualitative network model. Ambio. 2020. [4] Beverly S. et al.. Anchored fish aggregating devices for artisanal fisheries in South and Southeast Asia: benefits and risks. RAP Publ. 2012; 65. [5] Macfadyen G. et al. Abandoned, lost or otherwise discarded fishing gear. Food and Agriculture Organization of the United Nations (FAO); 2009. [6] Tsujimura TN. et al. Safety at Sea Assessment in the Timor-Leste Small-Scale Fisheries Sector. Technical Report. Bangkok: RFLP 2012 p. 41. [7] Tilley A, et al. Nearshore Fish Aggregating Devices Show Positive Outcomes for Sustainable Fisheries Development in Timor-Leste. Frontiers in Marine Science. 2019;6: 487.
Contact & resources	[Details of relevant MAF ND, agency/ organization that developed practice & links to contact or further information] Contact: Mario Pereira, WorldFish Timor-Leste, m.pereira@cgiar.org Primary research paper Tilley et al. (2019) [7] https://www.frontiersin.org/articles/10.3389/fmars.2019.00487/full Overview report on Fisheries in Timor-Leste: https://digitalarchive.worldfishcenter.org/handle/20.500.12348/3737